Can increased primary care access reduce demand for emergency care? Evidence from England's 7-day GP opening

Article (Accepted Version)

Can Increased Primary Care Access Reduce Demand for Emergency Care? Evidence from England's 7-Day GP Opening *

Peter Dolton† Vikram Pathania‡

Abstract

Restricted access to primary care can lead to avoidable, excessive use of expensive emergency care. Since 2013, partly to alleviate overcrowding at the Accident & Emergency (A&E) units of hospitals, the UK has been piloting 7-day opening of General Practitioner (GP) practices to improve primary care access for patients. We evaluate the impact of these pilots on patient attendances at A&E. We estimate that 7-day GP opening has reduced A&E attendances by patients of pilot practices by 9.9% with most of the impact on weekends which see A&E attendances fall by 17.9%. The effect is non-monotonic in case severity with most of the fall occurring in cases of moderate severity. An additional finding is that there is also a 9.9% fall in weekend hospital admissions (from A&E) which is entirely driven by a fall in admissions of elderly patients. The impact on A&E attendances appears to be bigger among wealthier patients. We present evidence in support of a causal interpretation of our results and discuss policy implications.

Keywords: Primary care, Physician Incentives, NHS, GP, A&E, ER

JEL classification: I11, I12, I18, H51

*We wish to thank the NHS and the CEP, at LSE for funding for this project. We gratefully acknowledge the able research assistance of Allen Wang and Wiktoria Tafesse, and valuable institutional context and details on the NHS from Dr Ruth O'Hare. We also thank seminar participants at the University of Sussex, and at the Royal Economic Society, Manchester (2015) for helpful feedback.

†Department of Economics, University of Sussex, & CEP, LSE. Email: p.dolton@sussex.ac.uk

‡Department of Economics, University of Sussex. Email: v.pathania@sussex.ac.uk

Introduction

There is a large literature on the impact of primary care on health system performance. Researchers have constructed various measures of the strength of primary care such as the availability of primary care physicians (PCP), and the comprehensiveness and continuity of primary care. Using geographical and temporal variation in these measures, studies have found that stronger primary care is associated with improved population health outcomes and lower hospitalisation rates. (Bindman et al. 1995; Macinko et al. 2003; Starfield 1991; Starfield and Shi 2002).

In England, the primary care physician is the General Practitioner (GP), who plays a central role in the National Health Service (NHS). In particular, the GP serves as a 'gatekeeper' to the more expensive secondary and tertiary care services. The GP's role has assumed increasing importance in recent years given mounting concern about the sustainability of England's NHS. It faces twin pressures of financial austerity, and of continually rising demand for services (Black 2013). Successive waves of past NHS reforms have emphasised the role of GPs in optimising the overall use of health care services.[1]

However, access to the GPs themselves has become an issue. The proportion of patients who reported finding it difficult to get through to their GP on the phone rose from 18% in 2012 to 24% in 2014. There has been speculation that lack of access to GPs is linked to worsening performance at Accident and Emergency (A&E) units of hospitals.[2] The number of A&E attendances has risen sharply from 16.5 million in 2003-4 to 21.8 million in 2013-14, a rise of 32%.[3]. Waiting times at A&E have increased, particularly in the major A&E departments which handle the largest patient volume (Blunt et al. 2015). The crisis in A&E has been at the forefront of the policy debate about the NHS. Politicians, policy makers, and the media have all focussed on GP practice opening times as both, a cause of the problem and a potential solution.[4]

The 'Prime Minister's Challenge Fund', was set up in 2013 to pilot seven day opening of GP practices.[5] While the main aim was to improve access to GPs, a major spillover benefit was the potential reduction in expensive A&E appointments by re-routing some patients to lower cost, routine visits to a local GP. The aim of this paper is to evaluate the impact of this intervention and retrieve a 'causal impact' of the 7-day opening policy on A&E attendances.

Using a difference-in-difference strategy, we find that the 7-day opening policy is associated with a significant and large 17.9% reduction in weekend A&E attendances from the pilot practices. The impact is non-monotonic in case severity. We find most of the reduction comes from a drop in

[1]The introduction of fundholding in 1991 was a major step towards sharpening GPs' gatekeeping incentives (Coulter 1995).

[2]A&E units in the UK are the emergency care units of local hospitals which would be called the Emergency Room (ER) or Emergency Department in the US.

[3]NHS England, "A&E Attendances and Emergency Admissions," `https://www.england.nhs.uk/statistics/statistical-work-areas/ae-waiting-times-and-activity/weekly-ae-sitreps-2014-15/`

[4]See, for example "Cameron tells GPs to work weekends," The Times, 30/09/14; at `http://www.thetimes.co.uk/tto/news/politics/article4222020.ece`, and "The Battle Over GP Opening," Nick Triggle, Health Correspondent, BBC News, at `http://www.bbc.co.uk/news/health-29424713`, accessed on 17/61/5.

[5]A GP practice is the term given to a primary care clinic in the UK. A GP practice may involve a single GP Principal or several GPs in partnership - or indeed a larger health centre which may have a panel of GPs.

cases of moderate severity (usually patients treated and discharged with instructions for follow-up with GPs or specialists). One would expect little or no effect on the most serious cases. Indeed, we find no impact on the count of A&E attendances that are induced by accidents. However, we do find an impact on A&E admissions which are also likely to be serious cases. This effect is entirely driven by an 19.2% fall in weekend A&E admissions of patients aged 60 years and above. Our intuition for this result is that A&E medical staff could be particularly risk averse when dealing with an elderly patient since at the time of consultation, they typically lack access to the patient's medical history. If in doubt, A&E physicians are likely to err on the side of caution and opt to admit such a patient. In contrast, had the same patient visited their GP, they might have been treated and sent home instead.

Curiously, there is a more modest drop in the least serious attendances - patients that are treated and discharged with no follow-up instructions or patients that leave the A&E without being treated. We provide suggestive evidence that some of the unresponsiveness in case counts is coming from the so-called 'frequent flyers' - patients who make frequent visits to the A&E.

Since the main effect of 7-day opening is through weekend access to GPs, we would expect to see the biggest impact on weekends. Indeed we find the largest effects on weekends. Within weekends, we find the effects are largest during the opening hours of the pilots. These findings arguably strengthen the case for a causal interpretation of the result. There is little evidence of spillover effects during weekdays. There is also little evidence of spatial spillover i.e. we do not find a significant impact on A&E attendances by patients of practices close to the pilot practices. This is consistent with the well documented preference among patients (especially those with long term conditions) for seeing their own GP. There is evidence of a bigger impact on wealthier patients. Plausibly, wealthier patients are better informed about any new policy. Also, wealthier patients have more of an incentive to use the GP instead of the A&E because of their higher marginal value of time, and the typically long waits at A&E.

We use rich administrative patient-level data - the Secondary Uses Service (SUS) data. We focus on 4 Central London GP practices that started piloting 7-day opening at various points in time starting April 2013. The pilots were not randomly assigned, and therefore we use 30 other GP practices in Central London as the control group. The 'treatment' and control group GP surgeries are part of the same Clinical Commissioning Group (CCG) - a coalition of GPs responsible for commissioning (60%) of health care services for the residents of Central London.[6] We provide evidence that the treatment and control groups are similar on key observables such as patient demographics, demand for health care, and patients' perceived access to GPs. We also show that in the period preceding the pilots, the two groups of GP practices shared a common time trend in key variables including the main outcome variable, namely weekly A&E attendances.

This paper makes a number of distinct contributions to the existing literature. First, the extant empirical research on A&E utilisation has been mostly non-experimental in nature - using either cross-sectional or before-after analysis. While a number of previous studies have suggested that

[6]This includes A&E attendances and unplanned admissions.

improved GP access is associated with lower A&E usage, we provide an empirical estimate of this link. Second, our paper contributes to the broader literature on patient use of costly and avoidable inpatient or emergency care instead of primary care. This is especially pertinent as such care may often be inefficient and clinically inappropriate for the patient - especially those with long term conditions. There are a number of notable US studies that have exploited quasi-experimental variation in insurance status to analyse patient health care choices. However, the lack of insurance is not an issue in our setting where care is essentially free at the point of delivery. We show that lack of timely access to primary care can lead to avoidable use of expensive emergency care. Third, our paper also relates to the theoretical and empirical literature on GP incentives as gatekeepers. A series of NHS reforms have emphasised capitation budgeting and patient choice to hone GPs' gatekeeping incentives. However, we find evidence of an unmet demand for weekend GP access that is leading to a costly spillover to A&E.

Our findings are topical given the mounting crisis at A&E units across the UK and the heated political debate on the best way to tackle this crisis. In particular, our results point towards potentially large cost savings of the 7-day opening policy by re-routing a substantial fraction of patients from A&E where a visit costs on average £114, and an admission costs £1489, to the GP where a visit costs £45 (Curtis 2013). The rest of the paper is laid out as follows. In the next section, we discuss the institutional context. That is followed by a brief literature review. Next, we set out the difference-in-difference count data model in the estimation section. We then describe the SUS data, and present evidence on covariate balance, and also key summary statistics. We then present and briefly discuss our results. Finally, we conclude by summarising our key findings, and outlining some policy implications.

Institutional Context

In the UK, the National Health Service (NHS) is by far the dominant health care provider. This care is free at the point of delivery and most of the general public does not have separate private medical insurance. In this context the aggregate demand for healthcare is potentially very large. The General Practitioner (GP) is intended to serve as a gatekeeper to maximize the cost efficiency of the system as well as best meet the clinical needs of the individual patient. Effectively this means GPs attempt to 'ration' care so that taxpayers' money is directed towards patients and procedures efficiently.[7]

In the UK, GP practices are mainly self employed small businesses. Traditionally, the business has been run by a single GP principal who derives their earnings from the residual 'profit' - total practice revenue minus the costs associated with employing staff (nurses, reception staff and sub-contracted doctors), paying for premises, and paying other business overheads. Increasingly, GP practices are partnerships of several GPs who take their salary on the basis of their share of the business profits after all costs have been defrayed. The revenue of an NHS general practice is

[7]See Malcomson (2004) for a theoretical treatment of physician gatekeeping incentives. Gaynor et al. (2004) examines similar gatekeeping incentives of physicians working for health maintenance organisations in the US.

predominantly from the NHS based on a capitation allowance for each patient. This capitation allowance varies considerably but will, in part, depend on the average deprivation of the patients who live in the area adjacent to the GP practice.

The gatekeeping incentives of GPs have been shifted by successive NHS reforms. A key change was the introduction of fundholding in 1991. The GPs were given the option to become fundholders. In that case they were given a budget from which to fund both primary and non-urgent elective secondary care for their patients; the intention was to have the GP internalise the costs of referring a patient to a consultant or a hospital. There is empirical evidence that fundholding changed GP practice patterns. Dusheiko et al. (2006) find that patients of fundholding GPs were less satisfied with care, and more likely to agree that their doctor was more concerned about curbing costs. Croxson et al. (2001) show that GPs had incentives to increase use of secondary care in the run up to fundholding to inflate their budgets. They find that indeed GPs increased hospital referrals prior to entry into fundholding, and then subsequently reduced such activity. Fundholding was abolished in 1997[8].

Since 2013, health care delivery in England has been organised through Clinical Commissioning Groups (CCGs). These are statutory bodies made up of all GPs in each geographical area who have been made responsible for commissioning all secondary health care for their patient community. These CCGs are intended to act as proxy consumers with the power to purchase and design provision of health care services. The premise is that GPs (in conjunction with other local network and service users) know best what their collective patient needs are and how to negotiate the best deal with the hospital (and third party) providers. The CCGs are funded directly by NHS England. GP practices receive 85% of their funding directly from NHS England (NHSE). The exact funding for each GP practice is based on their capitation allowance and list size (number of registered patients). GP practices obtain the remaining 15% of their funding directly from their local CCG. The NHSE also provides 40% of hospital revenue for 'specialist' services such as major surgery and other high cost provision. The CCGs receive 60% of the total NHS funding to commission services from hospitals (and other providers) which includes the provision for all outpatient appointments including A&E and all non-elective admissions via A&E. This provision is based on the provider contracts, negotiated on an annual basis, in the commissioning process.

Therefore the CCGs are incentivised to find ways to reduce A&E attendance and non-elective admissions.[9] This incentive has become particularly salient, given the rapid growth in the number of A&E attendances, that rose from 16.6 million in 2003-4 to 21.7 million in 2012-13 (Blunt 2014).

At the same time, there is also growing concern about the restricted times when GPs are

[8] Although fund holding was abolished, the split between the purchaser (i.e. commissioner) and the care provider that was introduced as part of the 1990 NHS Community Care Act was retained.

[9] According to a GP Principal in the Central London CCG, 'Reducing A&E attendances and non elective admissions are the top priorities for CCG budget control as it is believed they are amenable to change through better care in the community (GP, better social care, improved hand overs between professional caregivers etc). Non elective admissions are especially expensive and are the most likely antecedent event for an older person to be admitted to a care home, a significant cost the Local Authority. The hospital admission itself, it is believed can make an elderly person 'de compensate' and become apparently less functional in day to day living,' Email communication received June 16, 2015.

available. The GP Patient Survey (GPPS) in England, carried out regularly by Ipsos MORI through postal questionnaires sent to patients registered with GP practices in England, asks patients about their experience of using their GP services such as ease of access (including opening hours). The proportion of patients who reported finding it difficult to get through to their GP practice on the phone rose from 18% in 2012 to 24% in 2014. About 19% of the respondents in the 2013-14 survey said that the opening hours were inconvenient. Of these, 74% wanted GPs to be available on Saturday, and 31% wanted them available on Sunday.

Commenters and researchers have suggested that there is a link between the two phenomena - patients frustrated at the lack of access to GPs and the rising demand for A&E. Based on the 2013 GP Patient survey, Cowling et al. (2014) calculated that 1.6% of respondents went to A&E because they were unable to get a convenient GP appointment. At first glance, this appears to be a small fraction. However, GPs account for 90% of all contact with the NHS. Due to the sheer volume of GP appointments, the study estimated that about 26.5% of A&E attendances were preceded by the patient being unable to get a convenient GP appointment.

Both these phenomenon have attracted considerable media attention, and have become major policy concerns.[10]. In response to growing public concern, in October 2013 the UK Prime Minister announced the £50 million Challenge Fund to support pilot practices in improving access to general practice and stimulating innovative ways of providing primary care services. A core focus was 7-day GP opening.[11]. The 7-day GP opening scheme became a major NHS theme of the Conservative party in the run up to the May 2015 general election.[12]

7-day GP Opening in Central London CCG

The initial 7 Day Opening (7DO) pilot in 2013 was funded by the so called 'Winter Pressures' money. This was on a smaller scale to the the current pilot being evaluated which was paid for by the Prime Minister's Challenge Fund (PMCF). This money was routed via the CCGs to the participating GP practices. In early 2013, as part of this initative the Central London (CL) CCG decided to commission additional opening hours at weekends from some of its constituent GP practices to improve patient access to primary care. A key enabler was the shared IT platform which allows, conditional on patient consent, for practices other than the one with which the patient is registered, to share a patient's clinical record. The only constraint imposed by the CCG on this 7-day opening decision was that the pilot practices should be geographically spread out to ensure equity of access across the area covered by the CCG.

Central London CCG practices are divided into three administrative 'localities': North, Central and South. Each locality holds regular meetings to which the practices in the locality send represen-

[10]See for instance, "A&E crisis exposed: the real pressures facing the NHS and the valiant doctors and nurses trying to keep it on track", Robert Colville, The Telegraph, `http://www.telegraph.co.uk/news/nhs/11319627/AandE-in-crisis-a-special-report.html`, 12/1/15, accessed 17/6/15

[11]See, "Seven day, 8am to 8pm, GP access for hard working people," Department of Health, `https://www.gov.uk/government/news/seven-day-8am-8pm-gp-access-for-hard-working-people`, accessed 17/6/15

[12]See, "David Cameron promises seven-day GP access by 2020," Brian Wheeler, Political Reporter, BBC News, `http://www.bbc.co.uk/news/uk-politics-29415929`, 30/9/14, accessed 17/6/15.

tatives. There is also a monthly plenary meeting of all practices in the CCG to which all members of all GP practices which comprise the CL CCG are invited. In their respective meetings, the North and South Localities, decided that all practices that volunteered could pilot 7-day opening. In each of two localities, there were two volunteering practices. In the Central locality a vote was taken by the practice managers to decide between the two practices who volunteered. The Connaught Square Practice was chosen due to its more central and readily accessible geographical position within the Central locality. The final choices from each of the localities were given to the CCG commissioning managers who then agreed to a uniform service specification and contractual arrangement for the Saturday and Sunday opening. Table 1 lists the pilot practices, the start dates, and the weekend opening hours of 7-day opening.[13] Figure 1 maps the boundary of the Central London CCG, and the locations of its GP practices. The pilot practices are marked with asterisks and labelled on the map, while the control practices are numbered with names in the legend. Patients usually attend one of four A&E units marked on the map although only one, St. Mary's Hospital, falls within the geographical boundaries of the CCG.[14]

Of the five pilots, we only use four in the analysis. The fifth, Victoria Medical Centre, operates out of two physical locations. Only one of these locations piloted the 7-day opening, and the available data does not distinguish between patients registered at the two locations. Hence, we dropped Victoria Medical Centre from the analysis. Among the 31 potential 'control' practices, we omit the atypical Westminster School practice that is contracted to exclusively cater to Westminster School students. Thus, there are 30 'control' practices.

Each pilot practice was paid £185 per hour for the weekend openings. This was to cover 1 GP, 1 nurse and 2 receptionists on top of a per capita capitation payment. The payment was an 'at cost' payment and calculated on what it costs per hour to provide the service. The payment was to cover the opening hours on Saturday and Sunday, and was not conditional on the provision of any other service. Neither the opening hours nor the payment conditions changed over the course of the intervention period.

The pilot practices advertised the weekend opening through posters within the practices and on the practice windows. Information was included on the websites of practices of the CCG. There were attempts to advertise the pilots to patients of the other practices in the CCG. Fliers were distributed in pharmacies. Posters were placed on the front doors of practices close to the pilots as these were visible to patients when the front doors were closed. A large poster was also placed on the side of a telephone box near the A&E Dept at St Mary's Hospital. Coverage in local newspapers at the launch of the scheme also contributed to awareness.

Literature Review

There is a vast literature on the role of primary care in influencing health outcomes. Several cross-country comparisons have shown that strong primary care systems are associated with better

[13] Each start date is a Saturday.

[14] All the four hospitals also have Urgent Care Centres.

population health. Starfield (1991) measures the strength of primary care practice on several dimensions such as first-contact care, person-focused care over time, and coordinated comprehensive care in 11 industrialised countries in the 1980s. She finds that countries with higher measures on these dimensions also score well on health outcomes such as the incidence of low birth weight and post-neonatal mortality. Starfield and Shi (2002) conduct a similar cross-country analysis using more recent data and find better health outcomes in countries where primary care services are more comprehensive, and family-oriented i.e. the entire family uses the same primary care physician. Similar analyses have been conducted using panel data methods. For instance, in a panel of OECD countries spanning almost three decades (1970-1998), Macinko et al. (2003) find a strong positive correlation between the strength of primary care system and a range of key health outcomes. Starfield et al. (2005) provide a comprehensive summary of the evidence supporting the key contribution of primary care to population health. They discuss a number of potential mechanisms underlying this contribution, including primary care physicians' ability to diagnose and manage heath problems early, and primary care's role in reducing reliance on wasteful and even potentially harmful specialist care.

Directly relevant to our context is the reliance on expensive and potentially avoidable medical treatment such as inpatient and emergency care, instead of primary care which may also be less appropriate clinically for those patients with long term conditions. Many studies in the US have sought to understand reasons for the increased crowding in emergency departments (Hoot and Aronsky 2008). It has been hypothesised that uninsured patients who are unable to access primary care delay care until their condition deteriorates to the point that they are forced to turn to hospitals or emergency departments.[15] For instance, Weissman et al. (1992) find increased hospitalisation for the uninsured for medical conditions that could have been prevented by timely care. Braveman et al. (1994) find that the uninsured among appendicitis patients suffer from a higher rate of burst appendix, an outcome that is avoidable with prompt treatment. More recent studies have sought to exploit quasi-random variation in access to Medicare and Medicaid, the two largest public insurance programs in the United States to estimate the causal effects of the lack of insurance on health outcomes (Anderson et al. 2012; Card et al. 2008, 2009; Dafny and Gruber 2005; Finkelstein 2007).

Lack of insurance is not the only barrier to access to primary care. Lowe et al. (2005) find that Medicaid patients from primary care practices that open for more than 12 hours in the evening each week use emergency departments 20% less than Medicaid patients from practices that did not have evening hours. Several European studies also investigate the effect of variations in access to primary care on emergency care usage. One of the closest in spirit to this study is Thompson et al. (2010). They analyse the impact of the change in the 2004 GP Contract which reduced out-of-hours access to GPs. The authors grouped A&E attendances into 'trauma' and 'non-trauma' (less serious), and into daytime (GP working hours), and out-of-hours (night-time and weekends.)

[15]The uninsured may also turn to emergency departments because by federal law, hospitals that receive Medicaid or Medicare payments, have to treat all patients who show up in emergency departments, regardless of ability to pay.

They find a significant increase in out-of-hours non-trauma A&E attendances after 2004, and fail to find similar increase in 'trauma' A&E cases. Evidence from Italy suggests that extending primary care practice opening hours to 12 hours a day can reduce inappropriate emergency department use (Bruni et al. 2014).

A number of UK studies look at cross sectional variation in characteristics at the practice-level including differences in responses to the GP Satisfaction Surveys. Cowling et al. (2013) uses all GP practices in England where data is available (7,856 practices) while Bankart et al. (2011) uses 145 practices in two Primary Care Trusts in the East-Midlands. Besides considering the accessibility of primary care, the two studies also look at additional covariates like distance of the practice to the nearest A&E, practice list size (number of registered patients), and demand for primary care services. They find that access to primary care is a significant predictor, as are closeness to A&E, list size, and age and prevalence of heart disease.

A related group of studies analyse characteristics and beliefs of A&E users. The usual method is to survey patients attending A&E, classify them into urgent and non-urgent cases, and question them on the reasons for choosing A&E. Patients are often explicitly asked about unavailability of primary care e.g. "my GP was unavailable", etc (Lobachova et al. 2014). One study found that 50% of self-referrals attend for injuries and ask for X-rays that would usually not be provided by a general practice but will be provided by an A&E centre (Giesen et al. 2006). Patients often indicate that recommendations by family or friends influenced their decision to visit the A&E (Giesen et al. 2006; Penson et al. 2011). Patients also appear to search online for healthcare information before attending A&E (Benger and Jones 2008).

Data

Our main data source is the Secondary Uses Service (SUS) data which is the single comprehensive repository of patient level health care data across in England. This SUS data offers access to anonymised patient based data for the purposes other than direct clinical care. This rich administrative dataset is also used to support healthcare planning, care commissioning, payment by results, and policy planning. It is not, however, used for clinical decision making (hence the qualification 'secondary'). The data covers inpatient, outpatient and A&E attendances from April 2009 to February 2014 of patients registered with a group of NHS practices in Central London. The map in Figure 1 charts the boundary of the CCG and the location of the 34 practices.

These practices employ 312 GPs and serve over 190,000 patients. The SUS A&E data contains details of all visits to A&E centres by these patients from April 1 2009 to February 28, 2014. The data include the date and time of arrival at the A&E, patient NHS identity number (pseudonymized), age and gender, the practice at which the patient is registered at the time of the A&E visit, the name of the A&E provider and details of the diagnostics and treatment procedures, and various other process and outcome measures. For the purpose of our analysis, we construct weekend (and full week) practice-level counts of various types of A&E attendances. Specifically,

the A&E attendances are collapsed into practice-weekend (or week) counts resulting in 8704 (34 practices times 256 weeks) observations. We also separately analyse disaggregated counts - broken down by age cells or by neighbourhood wealth (proxied by median house price.)

We obtain information on a range of general practice characteristics from the NHS Information Centre Indicator Portal hosted and maintained by the Health & Social Care Information Centre (HSCIC).[16] These are publicly available data on a variety of practice characteristics such as the list size (the number of registered patients), the patient-GP ratio, patient demographics, measures of perceived accessibility of GPs at the practice, and clinical quality measures. The information on the website has been compiled from a number of different primary data sources such as the reports filed by general practices themselves, and patient surveys. This information is usually collected only on an annual basis and can be dated.

Types of A&E attendances

We expect the impact of weekend opening of practices on A&E visits to vary by case urgency and severity. Serious cases that require urgent care such as trauma induced by accidents would still present at A&E. Patients would either go there directly because of the seriousness of their condition, or be taken there by Emergency respondents such as the police, paramedics, or firefighters. One expects little or no change in the count of such types of A&E attendances from weekend access to GPs. However, some patients with less serious conditions might opt to visit the practice, if open, instead of heading to the A&E, and for such cases we might expect a drop in the count of A&E attendances.

In our data we identify six types of attendances that span a useful range of case urgency and severity; each type is informative in the own right.

1. **All cases**: This is the total count of all A&E attendees and captures the aggregate impact of the 7-day opening on A&E case flow.

2. **Admissions**: The count of A&E attendees who are hospitalised. These are arguably severe cases, and one would expect to see relatively little impact on the count of such cases. Admissions are also important for another reason - these are the most expensive A&E attendances since inpatient care is an order of magnitude more costly than outpatient care.

3. **Minor**: The count of A&E attendees who are discharged without any follow-up instructions, or those patients who either left before being treated or walked out after refusing treatment. Such cases are plausibly non-urgent and non-serious. Some of these patients might have opted to visit their GP if available rather than go to the A&E and so one would expect to see a fall in the count of minor attendances.

4. **Moderate**: The count of A&E attendees who are discharged with instructions to follow-up with the GP, or referred to an out-patient practice or another health care provider. While

[16] `https://indicators.ic.nhs.uk/webview/`

some of these cases could be fractures, burns or cuts that require urgent attention, other cases could be of mild to moderate severity e.g. flu, gastro-intestinal distrurbances etc that would benefit from medical care that a GP could also have provided. One might expect to see some reduction in the count of such 'moderate' A&E attendances.

5. **Ambulance**: The count of A&E attendees who are brought to A&E in an ambulance. One would expect little change in the count of such cases, if ambulances are used to ferry the most urgent cases. Also, like admissions, ambulance dispatches are expensive, and any change is of interest.

6. **Accident**: The count of A&E attendees who are tagged as caused by a traffic accident, assault, deliberate self harm, sports injury, fireworks injury, or other accidents. Most of these cases involve physical trauma and require urgent care. One would expect no impact on the count of such cases.

Descriptive statistics

Table 2 displays the mean values of several relevant covariates for the control and pilot practices. The covariates include the demographic and socio-economic characteristics of the registered patients, size of the practice, the patient/GP ratio, perceptions of GP accessibility as reported in the GP patient surveys, and measures of practice level clinical quality as captured in the Quality and Outcomes Framework (QOF). The last column reports the p-value from a 2-tailed t-test of difference in means between the two groups of practices using annual data from 2009-2012 i.e the pre-period in the study.[17] Note that as the 7-day opening was not randomised across practices, full covariate balance was not built in by design. Nevertheless, the two groups of practices have very similar values of most covariates with one notable exception. The patient-GP ratio is significantly higher in the pilot practices.

In the online web appendix, we investigate the reasons for the difference in the patient-GP ratio and present a number of arguments as to why this difference is not a threat to identification. First, and most importantly, much of the difference in the patient-GP ratio is driven by one outlier pilot which is an artefact of incorrect HSCIC data. Excluding this data point yield a patient-GP ratio for the pilots that is much closer to that of the control practices. Second, we use practice fixed effects in the regression analyses to soak up any time invariant differences across practices, and we show in the appendix that the common trends assumption appears to hold in both, practice list size and GP headcount. Third, an implication of the higher patient-GP ratio in the pilots is that the patients there may have worse access but as Table 2 shows, patients in both groups of practices report very similar perceptions on accessibility (although overall satisfaction at baseline was slightly lower among patients of the pilot practices.) A final and related argument is that the GP-patient ratio is not a reliable proxy for access since different GPs offer different number of weekly sessions. Practices differ in the mix of partners and salaried GPs, and part-time and full-time GPs. The

[17] Since three of the four pilot practices started the 7-day opening regime in 2013, we exclude data from 2013.

control group has some practices with a large number of GPs but many of those are part-time, so that the average number of weekly sessions per GP is lower in those practices.

The proportion of males among registered patients is higher than one would expect, and appears to reflect the demographics of Central London which hosts a large number of single young men engaged in male-dominated occupations such as finance.[18]

Table 3 displays the summary statistics of the A&E attendance counts by attendance type for the weekend and the entire week. A few points are worth noting. First, the A&E counts from the treatment practices are slightly higher that those of the control practices. Second, 'minor' cases comprise about 25% of all A&E attendances. Third, about 20% of the A&E attendances arrive by ambulance.

Methods

The distribution of weekend (and weekly) practice-level counts of all minor, and moderate cases, are close to continuous and can be analysed using OLS regression. However, the distribution of admissions, accidents, and ambulance cases more closely resemble typical count data, with a substantial fraction of zeroes. We therefore use count data regression models. Specifically, we run difference-in-difference Poisson specifications on the weekly count data[19]:

$$E[N_{iw}|.] = exp[\alpha_i + \alpha_w + \beta D_{iw}] \tag{1}$$

N_{iw} is the A&E attendance count while α_i and α_w are practice and week fixed effects. The weeks start on April 4, 2009 and end on February 28, 2014, a total of 256 weeks. D_{iw} is the 7-day opening dummy. N_{it} are A&E counts from practice i in week w. We compute robust standard errors clustered on the practice.

As explained above, we estimate equation (1) for the six different counts listed above. In each table, unless otherwise noted, we present the weekend results in the top panel and the full week results in the bottom panel. The coefficient of interest, β, is the % change in the A&E attendance count induced by the 7-day opening policy.

We expect to see the biggest impact of the 7-day opening policy on weekends because patients who previously would either have to wait until Monday (or later) to see a GP or go to the A&E, can now go to their GP. There is also potential spillover to weekdays e.g. the policy might reduce waiting times for appointments on weekdays and thereby reduce the number of patients opting for A&E. Therefore, we use daily practice-level counts to estimate:

[18] For instance, there were 105 males to every 100 females in the population of Westminster in 2011 with the workday population even more skewed at 115 males to every 100 females. See `http://www.ons.gov.uk/ons/dcp171776_333420.pdf`.

[19] As a robustness check we have also performed the analysis of weekend A&E attendances using OLS and negative binomial specifications. The results are very close to those reported here, and are available in the online web appendix.

$$E[N_{it}|.] = exp[\alpha_i + \alpha_{dow} + \alpha_w + \sum_{dow=1}^{7} \beta^{dow} D_{it} dow_t] \quad (2)$$

Here D_{it} is a dummy for 7-day opening for practice i on day t. The specifications controls for day of week fixed effects, α_{dow}, and for practice and week fixed effects as above. The relevant coefficients β^{dow}, $dow = 1, ..., 7$, from estimating equation (2) are presented graphically (point estimate and the 95% confidence interval) for ease of exposition.

Results

Table 4 presents the Poisson regressions estimates of the impact of the 7-day opening policy on A&E attendances. The difference-in-difference coefficients reported represent the relative change in the counts of A&E attendances by patients registered in the pilot practices versus those in treatment practices after the implementation of the 7-day opening. The top three panels display the estimated impact on weekend A&E attendances. The topmost panel does so for the entire weekend. We use the arrival time at the A&E to separately estimate the effect during the weekend hours when the pilots were open (the second panel), and when the pilots were closed (the third panel). There are a number of striking results for the weekend counts. First, there is a clear and significant drop in attendances. Total weekend attendances decline by 17.9%. Second, this drop is not uniform across types of cases; in particular, it appears to be non-monotonic in case severity. The sharpest drop is in the count of cases of moderate severity which declines by almost 20%. In contrast, there is no significant decline in the count of minor cases although the point estimate is relatively large and negative (-12.3%). On the other hand, there is a significant 10% drop in weekend admissions, arguably the most serious and urgent cases. Third, there is no significant change in cases caused by accidents. This is reassuring since one would expect such cases to always be taken to A&E, regardless of GP availability. Fourth, 7-day opening appears to be making a dent in the counts of two major sources of A&E expense - admissions as already noted, and ambulance usage. The latter shows a significant drop of nearly 20% on weekends. We show below that the fall in admissions occurs almost entirely among the elderly patients. Fifth, the drops in weekend A&E attendances are larger during the hours when the pilots were open.[20]

The impact on the weekdays counts is much smaller, and marginally significant only for all attendances and for moderate cases. Consequently, the impact on the full weekly counts is muted although it mirrors the weekend pattern. Nevertheless, the drop in the counts of total attendances and moderately severe cases remains large and significant. However, the small and mostly insignificant weekday coefficients suggest limited temporal spillover across weekdays. Below, we explicitly explore the effect by day of week.

[20]We thank an anonymous referee for suggesting that we analyse weekend A&E attendances by practice opening and closing hours.

Impact by day of week

Figure 2 charts the effect on A&E attendances by day of week. It is evident that the effects are much larger on weekends rather than weekdays - the biggest drops in counts of all attendances, admissions, and moderately severe cases are on Saturday and Sunday. This strongly suggests that the observed changes in counts are being driven by the weekend opening, and not by unobserved practice or time specific shocks. There is suggestive evidence of a reduction in counts of all attendances and of moderately severe cases across weekdays - the point estimates are negative although insignificant (except for moderately severe cases on Friday where the point estimate is positive but insignificant.) It is plausible that there is reduced demand for GP appointments on weekdays since some patients who would have sought weekday appointments are now able to meet the GPs on the weekend. This in turn could reduce the waiting time for a weekday GP appointment and thereby reduce the number of patients turning to A&E instead. The effect on cases induced by accidents is essentially zero on each day of week. The same is true for minor cases.

Impact by age

Table 5 presents the estimates of the impact of the 7-day opening by age group. We construct counts of A&E attendances for children (0-17), adults (18-59), and the elderly (60+). As seen before, the drop in attendances is non-monotonic in case severity. Across all age groups, the largest drops are observed in the moderately severe cases.

The fall in A&E attendances is the largest among the elderly. Notably, the 10% drop in weekend admissions observed in Table 4 appears to be driven almost entirely by the 19% fall in admissions among the elderly. At first glance, the observed drop in admissions is counter-intuitive. One would expect such cases to be serious and in need of urgent medical care, and therefore these cases would continue to flow to A&E even if the GP was available.[21]. However, A&E staff might be particularly risk averse when treating elderly patients. Since A&E staff do not have access to the patient's medical history, they have to quickly assess the patient's condition and form a judgment based on the patient's current symptoms and the patient's own account of past medical history. The consequences of misdiagnosis and hence the margin for error is plausibly smaller in the case of elderly patients and so A&E staff might choose to admit proportionately more of these patients. In contrast, the GP has access to the patient's medical history and may also have a long first hand experience of treating each specific elderly patient. Thus GPs would be better able to assess the seriousness of the case, and send the less-serious cases home after treatment. There is also a sharp fall of 29% of elderly cases brought to hospitals by ambulance.

Spillovers across practices

On a weekend, a GP in a pilot practice was, in principle, accessible to all patients registered with

[21] Increased GP access can, over the long run, reduce admissions by improving health outcomes e.g. by detecting and treating conditions before they become very serious.

any of the CCG practices, and not just the patients of that pilot practice. This was made possible by the shared IT platform which allows GPs to access practice records of patients across the CCG, conditional on patient consent. If patients from the control practices were also switching from A&E to the weekend GPs, then the estimated impact of 7-day opening is biased downwards (less negative than estimated.) Intuitively, the 7-day opening also reduced the A&E attendances for the control group in the post period, which would lead to an underestimate of the double difference. In practice, given the geographical spread of the practices and travel times, any spillover would be likely to have been local. Some patients registered at practices neighbouring the pilot practices might have made use of the weekend opening. We explicitly test for local spillovers. We identify and tag the three geographically closest practices to each of the pilot practices. Table 6 presents estimates of the impact of the 7-day opening on the pilot and on the nearest three practices. There is little evidence of spillover i.e. the A&E attendance counts of patients registered in the practices closest to the pilot practices do not appear to have changed significantly. The coefficients for the pilot practices (the top row) in Table 4 and Table 6 are very similar. If there was substantial spillover, we would have expected to see an increase in the magnitude of estimated impact of 7-day opening in the specification in Table 6 as compared to the results in Table 4. The coefficients for all attendances, minor cases, moderately severe cases, and cases brought by ambulance do increase in magnitude, but only very marginally. These findings are consistent with two plausible explanations. First, patients might have a strong preference for their own GP or practice, in which case they would still prefer to use A&E if their own GP in unavailable. About 55% of patients prefer to be seen by a particular GP (Ipsos MORI 2014). Second, it is also possible that the patients of the pilot practices are much more aware of the weekend opening than patients of other practices.[22]

Impact by neighbourhood wealth

Patients of different socio-economic strata could respond differentially to the 7-day opening. Wealthier patients might be better placed to access information online or through word of mouth about the new policy. In addition. wealthier patients may place a higher value on time. Visiting the A&E can entail long waiting times.[23] Table 7 presents estimate of the differential impact on A&E attendances by the average house price in a patient's neighbourhood. The house price is taken as a proxy for wealth.

For obvious confidentiality reasons, the SUS data do not provide the full postal code of the patient's residence. However, the data encode the Lower Super Output Area (LSOA) of the patient's residence. An LSOA can have anywhere between 1000 and 3000 residents. From the land registry,

[22]Based on email communication with the GP Principal at the Connaught Square Practice, we were informed that the CCG attempted to communicate the 7-day opening to all patients. However, awareness of the scheme appears to have spread mainly via word of mouth.

[23]While the national target was that at least 95% of A&E patients would be treated and either sent back home or admitted within 4 hours, the actual performance was only 92% in 2014. Those A&E patients who ended up being admitted spent an average 3 hours 43 minutes in the A&E before admission. Those who were treated and discharged spent an average 2 hours 17 minutes in A&E (Blunt et al. 2015).

annual data are available on the average house price at the LSOA level.[24] The average annual house price for each LSOA was further averaged from 2010-2013 to get a 4-year LSOA-level average. For the SUS A&E patient sample, the median of this 4-year average was £531,700. In the results reported in Table 7 the $P > Median$ dummy tags patients who reside in LSOAs with a 4-year average house price greater than £531,700. There is clear evidence of a differential impact. While there are significant drops in all attendances and cases of moderate severity in counts of patients from the less wealthy neighbourhoods (below median price), there are large and additional drops in patients from wealthier neighbourhoods.

Robustness Checks

In the absence of randomisation, we rely on the difference-in-difference method to construct a counterfactual trend using the control practices. A key identifying assumption is a common trend across the treatment and control groups in the pre-treatment period. We test this common trend assumption below. Another concern with difference-in-difference using panel data is that the standard errors tend to be biased downwards (Bertrand et al. 2004). We have used robust standard errors clustered on practice to more robustly assess statistical significance. In addition, we also implement an alternative specification proposed by Donald and Lang (2007) to check the robustness of the difference-in-difference estimates.

Leads and Lags

If the observed reduction in some of the A&E attendances are being caused by the 7-day opening policy, we should expect to see no effects for the pilot practices prior to the implementation of the policy. Also, if it takes a while for patients to become informed about the weekend opening, we would expect the effects to increase as time passes. In other words, we expect small and insignificant estimates in the weeks preceding the piloting and increasing estimates in successive weeks after the start of the pilots. To test this, we estimate the following specification:

$$E[N_{iw}|.] = exp[\alpha_i + \alpha_w + \sum_{j=-1}^{-3} \beta_j^{pre} Pre_{iw}^j + \sum_{k=0}^{3} \beta_k^{post} Post_{iw}^k] \quad (3)$$

Pre_{iw}^j is an indicator equal to 1 if weekend w falls within the jth 12-week block preceding the starting week of the 7-day opening in a pilot practice i. $Post_{iw}^k$ is defined similarly counting 12-week blocks going forward from the start of the pilots. Consider for instance Connaught Square practice which implemented the 7-day opening starting April 6 2013. For this practice, Pre_{iw}^{-1} is equal to 1 for weekends within the 12-week block ending on April 5 2013, while $Post_{iw}^0$ is equal to 0 for the 12-week block starting April 6, 2013. We include 3 lagging quarters and 4 leading quarters. Note that given SUS A&E data is only available until Feb 28, 2014, the full set of leading

[24] These data were accessed from `http://data.london.gov.uk/dataset/average-house-prices-ward-lsoa-msoa` on April 3, 2015.

quarters is not available for all pilot practices. For instance, Third Floor Lanark Road Medical Centre implemented the 7-day opening starting Jan 11, 2014. Therefore, it will have neither the 2nd or 3rd leading quarter in the data. Note also that the *Pre* and *Post* indicators are always zero for the control practices.

The estimates of β from equation 3 are displayed in Figure 3. The horizontal axis represents the time (in quarters) centred at 0 which denotes the first quarter starting with the launch of the 7-day opening pilot. The lagging quarters run from -3 to -1. The leading quarters run from 0 to 3. The plotted β show the quarter-specific different-in-difference estimates. For instance, β_{-1}^{pre} is the relative change in attendances in the pilots compared to the control practices in the quarter preceding the start of the pilot. Similarly, β_{1}^{post} captures the relative change in attendances in the pilots compared to the control practices in the second quarter after the launch of the pilot.

There is no evidence of a pre-existing downward trend in A&E attendances for the pilot practices compared to the control practices.[25] If anything, the point estimates suggest that the pilot clinics had a trend of increasing A&E attendance relative to the control practices in the period immediately preceding the start of the pilots. The point estimate of the impact of the 7-day opening increases with every successive 12-week block. It appears that information about the weekend opening disseminates slowly.

Donald and Lang estimator

We implement an alternative fixed effects procedure suggested by (Donald and Lang 2007) for each of the 4 pilot practices. We construct the unweighted average of A&E attendances from the 30 control practices to get a "control" time series. Next we compute the difference between the number of A&E attendances at a pilot practice and the average of the control practice. We then regress this difference on a *Post* dummy that codes the 7-day opening for that pilot. By construction, the point estimates from this simple time series regression will be identical to a regression with practice and time fixed effects. However, the standard errors in the Donald and Lang procedure are larger. The identifying assumption is that the difference in A&E attendances between the pilot practice and the average of the control group is *iid*. Since the left hand side variable in the second step of the Donald and Lang procedure is the difference in A&E counts, it can be negative at times. We cannot use count data models. Instead, we use simple OLS regression at the weekend level.

Table 8 displays the resulting estimates for each of the four pilots. The top row in each panel is the fixed effects estimate with robust standard errors clustered on practice. The bottom row in each panel is the Donald and Lang 2-stage estimator with Newey West standard errors computed at 5 lags (Newey and West 1987). The standard errors rise substantially, sometimes by twice.

[25] In the web appendix, we have explicitly tested for, and failed to find, divergent pre-existing trends in a range of practice-level accessibility and clinical quality variables. The accessibility variables include the number of GPs, the patient list size, and patients' perceptions of the ease of phone access, waiting times at the practice, satisfaction with opening hours, demand for opening on Saturday and on Sunday, and overall satisfaction with the practice. The clinical variables drawn from the Quality and Outcomes Framework include practice quality in managing coronary heart disease, diabetes, COPD, mental health, and asthma.

However, the estimated impact on all and moderate A&E attendance remains consistently negative and significant for each of the four pilots.

Discussion

The results suggest that 7-day opening of GP practices led to a significant drop in A&E attendances. As expected, the largest drop occurs on the weekends. The drop in A&E attendances is concentrated in cases of moderate severity. There is no evidence of any change in cases induced by accidents. The timing and the pattern of the estimated falls in A&E attendances point towards a causal effect of the 7-day opening policy. Additional corroborating evidence comes from a survey of GPs attending patients on weekend openings at one of the pilot practices.[26] Based on the GPs' assessment, about 56% of the patients would have sought out a weekday GP appointment if they had been unable to see a GP on the weekend. This suggests that the 7-day opening also helped to alleviate some of the pressure for weekday GP appointments. It is also likely that the 7-day opening may also have increased the overall take-up of GP appointments by lowering the (waiting time) cost of GP access at the margin. In the remaining 44% of the cases, the GPs indicated that the outcome in the absence of the weekend intervention would have been an attendance at an A&E. Thus, the weekend opening appears to have reduced some of the avoidable spillover to A&E.

One counter-intuitive result is that drop in A&E attendances of minor severity is smaller than those of moderate severity. Part of the explanation may be the so-called 'frequent flyers' - patients who consistently attend several healthcare providers including A&E and general practices regularly. There are two pieces of evidence that support this hypothesis. First, the distribution of A&E attendances by frequency of patient visits is very right skewed.[27] About half the patients only visited the A&E once and these patients accounted for less than 20% of all A&E visits. in contrast, the top 5% of patients in terms of frequency of visits (those who visited the A&E 8 times or more) account for over 26% of the visits. And the top 0.1% visited the A&E 37 times or more, and account for almost 2.9% of all A&E visits. Second, the drop in minor A&E attendances is concentrated among the low frequency visitors with no drop among the high frequency visitors. Specifically, when we estimate equation (1) for the sample of patients who visited A&E only 1-3 times during the study period, there is a significant drop of about 26% ($p<0.01$) in minor cases. However, among frequent visitors (4 times or more), there is essentially no change in the count of minor cases.[28]

The inefficiency caused by clinically unnecessary attendance at A&E can be gauged by comparing both, the relative cost and the quality of care provided at A&E versus that provided by a GP. The average cost of A&E visit is £114. This excludes the cost of ambulance call-outs which average £220. The average cost of a non-elective admission is £1489. In contrast, the average cost

[26]The survey was conducted over three consecutive weekends in May in the Connaught Sq Practice. A total of 255 patients visited practice over the three weekends. After seeing each patient, the GP completed a response to the question, "In your clinical opinion, what other primary care or urgent care services do you believe the patient might have accessed in the next two weeks, if your intervention had not taken place?"

[27]The SUS data has an anonymised patient identity number that allows us to track the same patient over time.

[28]The web appendix contains the results of the analyses of impact of minor attendances by frequency of A&E use.

of a GP visit is £45 (Curtis 2013; Department of Health 2013). Costs aside, it is important to note that patient healthcare, in many cases, could be better delivered by a visit to their GP. This ensures continuity of care in the sense that the GP treatment is based on direct past experience with the patient and access to her medical records. This information is not available at an A&E consultation. Typically, A&E doctors are junior to GPs who are equivalent to hospital consultants in terms of their medical training and expertise. One rarely sees much of the consultant in A&E as traditionally - the bulk of the care in A&E is administered by nurses or junior doctors.

An A&E attendance is optimal if the patient is in urgent need of technology based care, as hospitals have access to much more equipment and specialist medical expertise than a GP practice. Those not in urgent need of such care can arguably be better treated at the GP practice. This fact is not fully appreciated by patients who may automatically equate the size and complexity of a large hospital based A&E unit with higher quality care. Furthermore, from the patient's perspective care is free in either place. Consequently, the patient's incentives to demand weekend access to GPs may be muted.

Nevertheless, our results suggest that a significant number of patients shift to GPs on the weekends once that option becomes available and hence there is evidence of unmet demand for weekend opening. Why then do GPs supply insufficient weekend opening hours? Patients are free to register with any GP practice serving their place of residence, and to switch to another practice if they are dissatisfied with limited opening hours or the quality of provision. The limited evidence available suggests that few patients do this other than when they move to a new address. Nominally, the cost of changing one's GP practice is not high. One can simply register at another practice as long as that practice is accepting new patients. Occasionally though, it can take up to 6 months for medical records to be transferred. The key reason for the lack of movement is that, over time, patients build up a rapport with their 'own' GP. Rubin et al. (2006) find that many patients will trade off shorter waiting times for the ability to see a GP of their choice, and that this preference is pronounced for women, the elderly, and those will long standing illness.

Caution is advisable in considering the broader applicability of our findings. Our difference-in-difference estimate is an average treatment effect on the treated (Athey and Imbens 2006). We have remarked on the relatively high GP-patient ratio in the pilots. While much of this is driven by undercounting of GPs in one of the pilots, it is still the case that none of the pilot practices have a large number of GPs in contrast to few of the control practices. We have argued that this difference is unlikely to cause differences in patient access. But it is possible that those practices that volunteered to take part in the pilot could reach the decision to do so more easily as fewer GP partners were involved in making the internal management decision to switch to 7 day opening.

There are many other questions and policy options which we have not considered. For instance, the NHS could make more extensive use of triage nurses and other more junior doctors to cut down costs and to act as gatekeepers of the more expensive services in hospitals. Innovations such as telephone hotlines, email or Skype and other internet based consultation, could also facilitate access to primary care. Recently, some of the 7-day opening pilots have scaled back their opening

hours citing lack of sufficient demand.[29] However, the four pilots analysed in this study had not reduced their weekend opening hours as of October 2015. This suggests that the 7-day opening regime may be optimal in the long run only in strategically located practices.

How the reduced A&E attendances play out at the A&E units is also an open question. A&E staff might be able to devote more time and effort to the most urgent cases. While the full cost savings of reduced attendances would not be realised, there would be benefits from improved quality of A&E care. However, it is also conceivable that A&E staff reduce effort as case numbers fall. Finally, in the long run some patients might respond to less crowded A&E units by increasing the frequency of their visits.[30]

Conclusion

Starting from April 2013, some GP practices in Central London started piloting 7-day opening to facilitate access to GPs on the weekends. Using a difference-in-difference methodology, we evaluate the impact of 7-day opening. We find a large and statistically significant reduction of 9.9% in A&E attendances overall and 17.9% in weekend A&E attendances by the patients registered at the pilot practices. This is an intuitive result since patients now have the choice of going to their GP on the weekend instead of visiting the A&E or trying to book an appointment with their GP on a following weekday.

The impact of 7-day opening is not monotonically decreasing in case severity. The fall is largest among cases of moderate severity. Counter-intuitively, there is a more modest and insignificant drop in A&E attendances of minor severity. This may be linked to the behaviour of the so-called 'frequent flyers' - patients who visit the A&E frequently. Indeed we find no evidence of a drop in A&E attendances by the more frequent visitors. Especially remarkable is that we find a significant reduction of 9.9% in unplanned hospital admissions. This drop is entirely concentrated among elderly patients (over 60 years of age). This is arguably a key finding since it has significant implications for the health and well being of elderly patients, and suggests potentially large cost savings. Our intuition for this result is that A&E staff are especially risk averse when treating an elderly patient - the perceived margin for error is small. Since the A&E physicians lack access to the patients' medical history, they might err on the side of caution and prefer to admit many such cases. However, if instead such a patient was able to visit her GP who is familiar with the patient's history and can form a more informed judgment, she might be treated and sent home instead of being hospitalised.

The case for a causal interpretation of the estimated impact is supported by a number of findings. First, and perhaps most importantly, we would expect the largest impact on the weekends, and the weekend estimates are indeed the largest. Second, in a difference-in-difference framework, a

[29] "Half of PM's seven-day GP access pilots have cut opening hours", Pulse, 29 September 2015

[30] In the web appendix, we investigate the effect of the pilots on waiting times at the A&E in St. Mary's Hospital and find no discernible change. This is not surprising since the pilots accounted for only 11.5% of A&E attendances at that hospital from all the Central London CCG practices, and our weekend impact estimate implies a drop of merely $0.115 * 0.18 = 2\%$ in attendances.

common pre-existing trend is a crucial identifying assumption. Reassuringly, we find that the treatment and control practices share a common trend in the run-up to the 7-D.O. piloting. Third, our finding survives a useful placebo test. We do not expect to see any change in the count of cases induced by accidents since these almost always involve trauma and will either self-refer or be brought directly to A&E by first responders. Indeed, there is no significant change in A&E attendances for such cases.

There is no evidence of significant spatial spillovers - A&E attendances by patients of the practices nearest to the pilots do not change. Finally, there is some evidence that wealthier patients respond more to the 7-day opening by switching from A&E to the GPs.

There are many implications of our findings for the way in which primary healthcare is provided. It is naive to suggest though that the problem of excess demand at A&E can be solved by simply make GPs work more hours. Given that GPs are self employed businesses, there is no current incentive for them to do so. A practice's revenue is limited by their capitation payment i.e. under the present system there no marginal incentive to supply extra hours (aside from special one-off initiatives like the Prime Minister's Challenge Fund). One alternative is to mandate that all GP practices should open specific regular hours and prescribe clear and transparent guidelines of out-of-hours cover. But this could significantly demotivate the existing GP workforce and could also result in a reduced supply of future GPs. One possibility to incentivise GPs to switch to 7-day opening is to re-allocate to the GPs the money saved by hospital A&Es due to reduced A&E attendances. If the savings can be internalised, incentives could be aligned.

References

Anderson, Michael, Carlos Dobkin, and Tal Gross, "The Effect of Health Insurance Coverage on the Use of Medical Services," *American Economic Journal. Economic Policy*, 2012, *4* (1), 1.

Athey, Susan and Guido W Imbens, "Identification and inference in nonlinear difference-in-differences models," *Econometrica*, 2006, *74* (2), 431–497.

Bankart, MJG, R Baker, A Rashid, M Habiba, J Banerjee, R Hsu, S Conroy, S Agarwal, and A Wilson, "Characteristics of general practices associated with emergency admission rates to hospital: a cross-sectional study," *Emergency Medicine Journal*, 2011, *28* (7), 558–563.

Benger, JR and V Jones, "Why are we here? A study of patient actions prior to emergency hospital admission," *Emergency Medicine Journal*, 2008, *25* (7), 424–427.

Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan, "How Much Should We Trust Differences-in-Differences Estimates?," *Quarterly Journal of Economics*, 2004, *119* (1), 249–275.

Bindman, Andrew B, Kevin Grumbach, Dennis Osmond, Miriam Komaromy, Karen Vranizan, Nicole Lurie, John Billings, and Anita Stewart, "Preventable hospitalizations and access to health care," *Journal of American Medical Association*, 1995, *274* (4), 305–311.

Black, Nicholas, "Can England's NHS survive?," *New England Journal of Medicine*, 2013, *369* (1), 1–3.

Blunt, Ian, "Focus on: A&E attendances," Technical Report, The Health Foundation and Nuffield Trust July 2014.

_ , Nigel Edwards, and Leonora Merry, "What's Behind the A&E 'Crisis'?," Policy Briefing 3, Nuffield Trust March 2015.

Braveman, Paula, V Mylo Schaaf, Susan Egerter, Trude Bennett, and William Schecter, "Insurance-related differences in the risk of ruptured appendix," *New England Journal of Medicine*, 1994, *331* (7), 444–449.

Bruni, Matteo Lippi, Irene Mammi, and Cristina Ugolini, "Does the extension of primary care practice opening hours reduce the use of emergency services?," Technical Report 978, Department of Economics, University of Bologna 2014.

Card, David, Carlos Dobkin, and Nicole Maestas, "The Impact of Nearly Universal Insurance Coverage on Health Care Utilization: Evidence from Medicare," *American Economic Review*, 2008, *98* (5), 2242–2258.

_ , _ , and _ , "Does Medicare Save Lives?," *The Quarterly Journal of Economics*, 2009, *124* (2), 597–636.

Coulter, Angela, "Shifting the balance from secondary to primary care.," *BMJ: British Medical Journal*, 1995, *311* (7018), 1447.

Cowling, Thomas E, Elizabeth V Cecil, Michael A Soljak, John Tayu Lee, Christopher Millett, Azeem Majeed, Robert M Wachter, and Matthew J Harris, "Access to primary care and visits to emergency departments in England: a cross-sectional, population-based study," *PloS one*, 2013, *8* (6).

_ , Matthew J Harris, Hilary C Watt, Daniel C Gibbons, and Azeem Majeed, "Access to general practice and visits to accident and emergency departments in England: cross-sectional analysis of a national patient survey," *British Journal of General Practice*, 2014, *64* (624), e434–e439.

Croxson, Bronwyn, Carol Propper, and Andy Perkins, "Do doctors respond to financial incentives? UK family doctors and the GP fundholder scheme," *Journal of Public Economics*, 2001, *79* (2), 375–398.

Curtis, Lesley, "Unit costs of health and social care 2013," Technical Report, Personal Social Services Research Unit, University of Kent 2013.

Dafny, Leemore and Jonathan Gruber, "Public insurance and child hospitalizations: access and efficiency effects," *Journal of Public Economics*, 2005, *89* (1), 109–129.

Department of Health, "Reference Costs 2012-2013," Technical Report November 2013.

Donald, Stephen G and Kevin Lang, "Inference with difference-in-differences and other panel data," *The Review of Economics and Statistics*, 2007, *89* (2), 221–233.

Dusheiko, Mark, Hugh Gravelle, Rowena Jacobs, and Peter Smith, "The effect of financial incentives on gatekeeping doctors: evidence from a natural experiment," *Journal of Health Economics*, 2006, *25* (3), 449–478.

Finkelstein, Amy, "The Aggregate Effects of Health Insurance: Evidence from the Introduction of Medicare," *The Quarterly Journal of Economics*, 2007, pp. 1–37.

Gaynor, Martin, James B Rebitzer, and Lowell J Taylor, "Physician incentives in health maintenance organizations," *Journal of Political Economy*, 2004, *112* (4), 915–931.

Giesen, Paul, Erik Franssen, Henk Mokkink, Wil van den Bosch, Arie van Vugt, and Richard Grol, "Patients either contacting a general practice cooperative or accident and emergency department out of hours: a comparison," *Emergency Medicine Journal*, 2006, *23* (9), 731–734.

Hoot, Nathan R and Dominik Aronsky, "Systematic review of emergency department crowding: causes, effects, and solutions," *Annals of Emergency Medicine*, 2008, *52* (2), 126–136.

Ipsos MORI, "GP Patient Survey — GP Patient Survey - National summary report," July 2014 Publication, Ipsos MORI Social Research Institute July 2014.

Lobachova, Lana, David FM Brown, Julia Sinclair, Yuchaio Chang, Korie Zink Thielker, and John T Nagurney, "Patient and Provider Perceptions of Why Patients Seek Care in Emergency Departments," *The Journal of Emergency Medicine*, 2014, *46* (1), 104–112.

Lowe, Robert A, A Russell Localio, Donald F Schwarz, Sankey Williams, Lucy Wolf Tuton, Staci Maroney, David Nicklin, Neil Goldfarb, Deneen D Vojta, and Harold I Feldman, "Association between primary care practice characteristics and emergency department use in a Medicaid managed care organization," *Medical Care*, 2005, *43* (8), 792–800.

Macinko, James, Barbara Starfield, and Leiyu Shi, "The contribution of primary care systems to health outcomes within Organization for Economic Cooperation and Development (OECD) countries, 1970–1998," *Health Services Research*, 2003, *38* (3), 831–865.

Malcomson, James M, "Health service gatekeepers," *RAND Journal of Economics*, 2004, pp. 401–421.

Newey, Whitney K and Kenneth D West, "A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix," *Econometrica*, 1987, *55* (3), 703–708.

Penson, Robert, Patricia Coleman, Suzanne Mason, and Jon Nicholl, "Why do patients with minor or moderate conditions that could be managed in other settings attend the emergency department?," *Emergency Medicine Journal*, 2011, *29* (6), 487–491.

Rubin, Greg, Angela Bate, Ajay George, Phil Shackley, and Nicola Hall, "Preferences for access to the GP: a discrete choice experiment," *British Journal of General Practice*, 2006, *56* (531), 743–748.

Starfield, Barbara, "Primary care and health: a cross-national comparison," *Journal of American Medical Association*, 1991, *266* (16), 2268–2271.

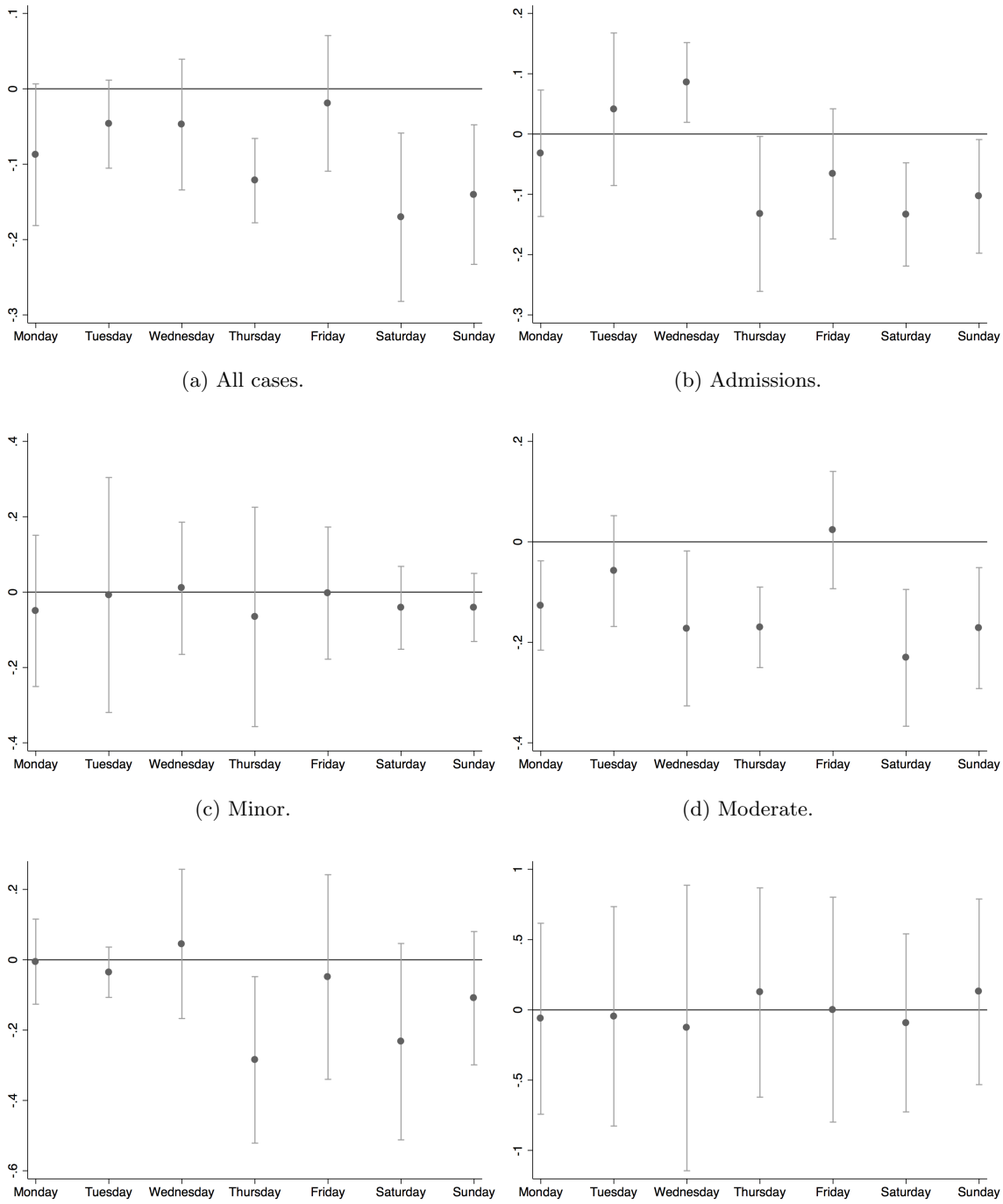
_ **and Leiyu Shi**, "Policy relevant determinants of health: an international perspective," *Health Policy*, 2002, *60* (3), 201–218.

_ **,** _ **, and James Macinko**, "Contribution of primary care to health systems and health," *Milbank Quarterly*, 2005, *83* (3), 457–502.

Thompson, C, C Hayhurst, and A Boyle, "How have changes to out-of-hours primary care services since 2004 affected emergency department attendances at a UK District General Hospital? A longitudinal study," *Emergency Medicine Journal*, 2010, *27* (1), 22–25.

Weissman, Joel S, Constantine Gatsonis, and Arnold M Epstein, "Rates of avoidable hospitalization by insurance status in Massachusetts and Maryland," *Journal of American Medical Association*, 1992, *268* (17), 2388–2394.

Figure 1: **Central London CCG and its GP practices**



(a) All cases.

(b) Admissions.

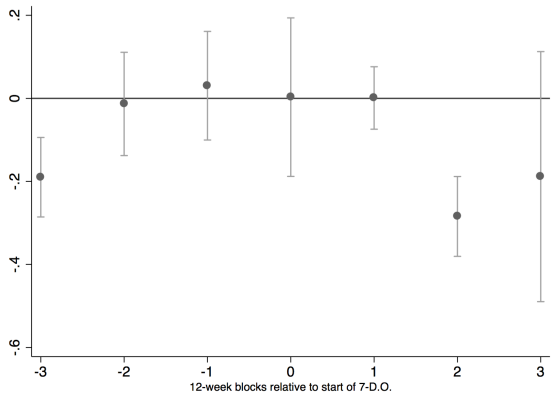
(c) Minor.

(d) Moderate.

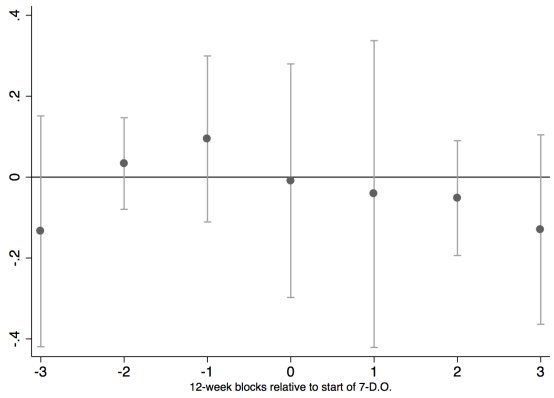
(e) Ambulance.

(f) Accident.

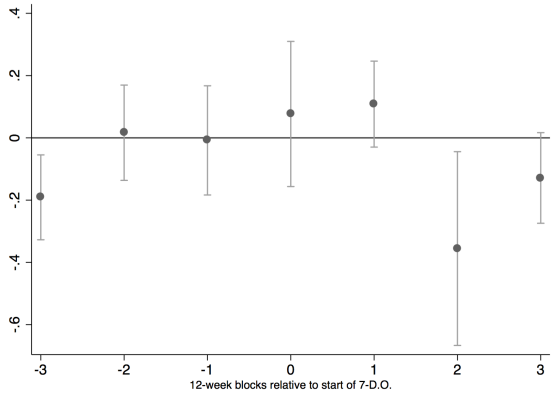
Figure 2: 7-DO impact by day of week (point estimate and 95% CI.)



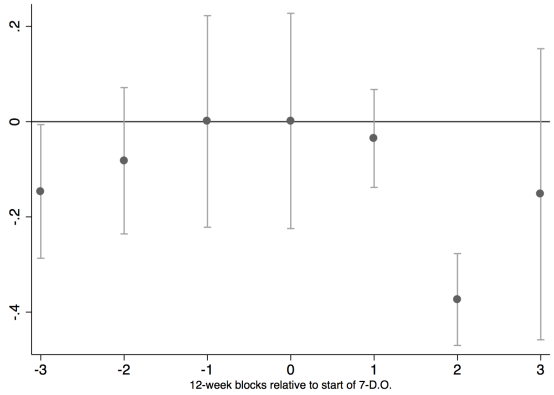
(a) All cases.



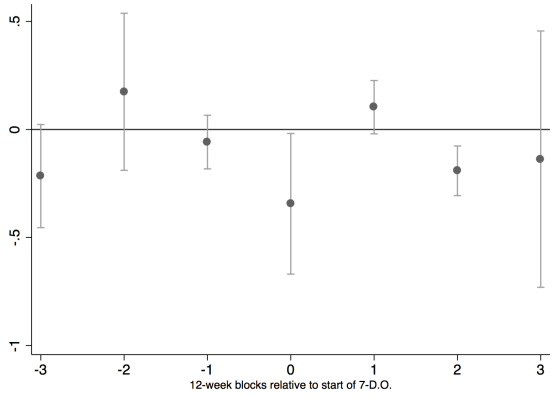
(b) Admissions.



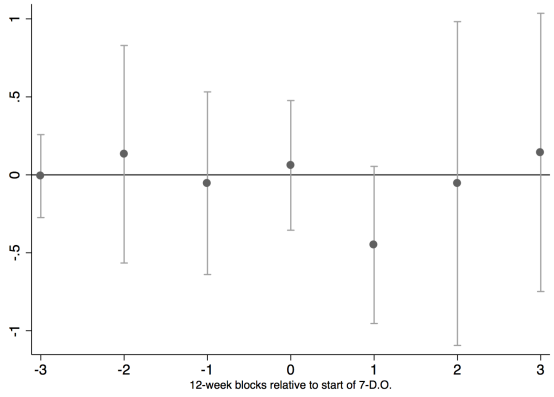
(c) Minor.



(d) Moderate.



(e) Ambulance.



(f) Accident.

Figure 3: 12-week leads and lags relative to the start of 7-DO (weekend counts)

Table 1: **7-Day Opening Pilot practices in Central London**

GP practice	**Start date**	**End date**[1]	**Weekend opening hours**
Connaught Square practice	6/4/13	28/2/14	10:00-18:00
North West London Medical Centre	18/5/13	28/2/14	08:00-16:00
Third Floor Lanark Medical Centre	11/1/14	28/2/14	10:00-18:00
Westminster and Pimlico Health Centre	25/5/13	28/2/14	10:00-13:00 & 14:00-18:00

Victoria Medical Centre also piloted the 7-day opening from 7/12/13-31/3/14. But we drop this practice from the analysis as it has two physical locations of which only one piloted the 7-D.O., and the SUS A&E data does not permit separate identification of patients from the two locations.

[1] The end date here denotes the end of the study period. The 7-day opening pilot in these practices continued to run beyond this date.

Table 2: **Baseline covariate balance: registered patient demographics, practice size, perceived accessibility, and clinical quality**

	Control	**Pilot**	**p-value**[1]
		Patient demographics[2]	
Male	0.547	0.550	0.945
	(0.074)	(0.038)	
0-4 years	0.049	0.047	0.874
	(0.021)	(0.016)	
65+ years	0.094	0.112	0.321
	(0.033)	(0.027)	
White	0.716	0.685	0.622
	(0.114)	(0.158)	
Index of Multiple Deprivation	24.527	23.499	0.777
	(7.022)	(2.949)	
		Number of patients[3]	
List size	5396	5500	0.88
	(2505)	(2626)	
Patient/GP ratio	1725	3150	0.00
	(881)	(1638)	
		Patients' perceptions on accessibility[4]	
% saying phone access easy	76	79	0.33
	(10)	(5)	
% saying wait time at practice 'not too long'	60	58	0.63
	(14)	(8)	
% satisfied with opening hours	80	80	0.80
	(6)	(7)	
% wanting surgery to open on Saturday	56	59	0.39
	(14)	(12)	
% wanting surgery to open on Sunday	13	11	0.75
	(14)	(13)	
% satisfied overall	88	81	0.00
	(5)	(7)	
		Clinical quality[5]	
Coronary heart disease	0.95	0.98	0.27
	(0.13)	(0.04)	
Diabetes	0.95	0.96	0.59
	(0.09)	(0.04)	
COPD	0.87	0.92	0.45
	(0.24)	(0.13)	
Mental health	0.89	0.92	0.54
	(0.18)	(0.10)	
Asthma	0.93	0.98	0.29
	(0.19)	(0.05)	
Total Clinical (%)	92.43	94.87	0.42
	(11.82)	(5.35)	
Overall (%)	90.95	92.30	0.61
	(10.17)	(8.18)	

Standard errors in parenthesis.
Computed from annual practice level data from 2009-2012 unless otherwise specified.
[1] p-value is for the 2-tailed t-test of difference in means.
[2] Patient demographic data are for 2010-2011. The % white is computed from the GP patient surveys.
[3] Data on practice list size and GP counts sent by HSCIC in response to our enquiry.
[4] Data downloaded from `https://gp-patient.co.uk`.
[5] Clinical domain quality indicators in the Quality and Outcomes Framework; downloaded from `http://qof.hscic.gov.uk`. Total Clinical refers to points scored across all clinical domains as % of clinical domain points available. The row 'Overall' refers to points scored across clinical and all other domains as % of all points available.

Table 3: **Mean practice-level A&E case counts - weekend and weekly**

	All cases	Admissions	Minor	Moderate	Ambulance	Accident
			Weekend			
Control practices (30)	8.357	1.232	2.004	4.105	1.668	0.911
	(5.549)	(1.334)	(1.909)	(3.703)	(1.850)	(1.317)
Pilot practices (4)	8.626	1.355	2.335	4.011	1.771	1.044
	(5.190)	(1.461)	(2.565)	(2.644)	(1.735)	(1.296)
			Weekly			
Control practices (30)	29.815	4.946	7.322	13.916	6.146	3.068
	(17.197)	(3.729)	(5.044)	(10.809)	(5.591)	(3.433)
Pilot practices (4)	30.930	5.506	8.016	13.778	6.482	3.325
	(15.105)	(4.274)	(6.980)	(6.387)	(4.796)	(3.085)
Observations	8,704	8,704	8,704	8,704	8,704	8,704

Mean weekly practice-level counts; standard errors in parenthesis.
All data from SUS from 1/4/2009 to 28/2/2014.

Table 4: **Impact of 7-day practice opening on A&E case counts**

	All cases	Admissions	Minor	Moderate	Ambulance	Accident
			Weekend			
7-DO	-0.179***	-0.099**	-0.123	-0.199***	-0.193***	-0.048
	[0.039]	[0.048]	[0.087]	[0.035]	[0.075]	[0.326]
Constant	2.065***	0.624***	0.837***	0.948***	0.261	0.530***
	[0.058]	[0.151]	[0.169]	[0.071]	[0.228]	[0.134]
			Weekend GP open[1]			
7-DO	-0.239***	-0.239***	-0.145*	-0.218***	-0.322***	-0.095
	[0.041]	[0.063]	[0.086]	[0.067]	[0.082]	[0.320]
Constant	1.405***	-0.289	0.156	0.426***	-0.737**	0.140
	[0.095]	[0.229]	[0.246]	[0.107]	[0.290]	[0.182]
			Weekend GP closed			
7-DO	-0.114*	0.023	-0.095	-0.180***	-0.113	-0.005
	[0.063]	[0.058]	[0.100]	[0.067]	[0.121]	[0.369]
Constant	1.335***	0.113	0.132	0.056	-0.218	-0.499***
	[0.078]	[0.200]	[0.174]	[0.117]	[0.251]	[0.193]
			Weekdays			
7-DO	-0.069*	-0.047	-0.003	-0.105**	-0.068	-0.074
	[0.042]	[0.043]	[0.092]	[0.042]	[0.078]	[0.404]
Constant	2.941***	1.444***	1.805***	1.775***	0.744***	1.263***
	[0.047]	[0.125]	[0.078]	[0.060]	[0.265]	[0.096]
			Weekly			
7-DO	-0.099***	-0.059	-0.037	-0.131***	-0.101	-0.068
	[0.038]	[0.037]	[0.085]	[0.038]	[0.075]	[0.377]
Constant	3.289***	1.808***	2.129***	2.138***	1.226***	1.657***
	[0.039]	[0.108]	[0.064]	[0.052]	[0.234]	[0.080]
Observations	8,704	8,704	8,704	8,704	8,704	8,704

Robust standard errors clustered on practice in brackets.
Poisson regression on weekend (Sat-Sun), weekdays (Mon-Fri), and full week practice-level A&E counts (1/4/2009-28/2/2014).
[1] See Table 1 for weekend opening hours of the pilots

Table 5: **Impact on A&E case counts by age group**

Age group	All cases	Admissions	Minor	Moderate	Ambulance	Accident
			Weekend			
0-17	-0.125***	-0.025	-0.098	-0.144*	-0.297	0.364
	[0.033]	[0.201]	[0.203]	[0.075]	[0.229]	[0.340]
18-59	-0.188***	-0.006	-0.105*	-0.216***	-0.098	-0.264
	[0.061]	[0.084]	[0.061]	[0.057]	[0.125]	[0.324]
60+	-0.206***	-0.192***	-0.023	-0.286***	-0.290***	-0.017
	[0.038]	[0.069]	[0.187]	[0.061]	[0.068]	[0.380]
			Weekly			
0-17	-0.078	0.083	-0.042	-0.123*	-0.127	0.327
	[0.064]	[0.156]	[0.167]	[0.074]	[0.245]	[0.373]
18-59	-0.090**	-0.016	-0.006	-0.119***	-0.016	-0.200
	[0.042]	[0.070]	[0.055]	[0.040]	[0.079]	[0.386]
60+	-0.125***	-0.115**	-0.017	-0.208	-0.203***	-0.209
	[0.040]	[0.052]	[0.085]	[0.130]	[0.060]	[0.391]
Observations	8,704	8,704	8,704	8,704	8,704	8,704

Robust standard errors clustered on practice in brackets.
Poisson regression coefficients on the 7-day opening dummy using weekend (and full week) A&E counts from each practice (1/4/2009-28/2/2014).
practice and week fixed effects.

Table 6: **A&E case counts : spillover impact on neighbouring practices**

	All cases	Admissions	Minor	Moderate	Ambulance	Accident
			Weekend			
7-DO	-0.189***	-0.091	-0.147*	-0.209***	-0.205**	-0.032
	[0.049]	[0.063]	[0.088]	[0.045]	[0.083]	[0.331]
Nearest 3	-0.028	0.019	-0.070	-0.032	-0.034	0.045
	[0.041]	[0.080]	[0.098]	[0.051]	[0.059]	[0.244]
Constant	2.068***	0.622***	0.844***	0.952***	0.265	0.528***
	[0.058]	[0.152]	[0.171]	[0.071]	[0.230]	[0.131]
			Weekly			
7-DO	-0.111**	-0.079*	-0.058	-0.145***	-0.115	-0.076
	[0.047]	[0.046]	[0.088]	[0.048]	[0.083]	[0.380]
Nearest 3	-0.033	-0.051	-0.061	-0.040	-0.036	-0.022
	[0.042]	[0.050]	[0.076]	[0.053]	[0.054]	[0.221]
Constant	3.293***	1.813***	2.135***	2.142***	1.230***	1.658***
	[0.037]	[0.109]	[0.063]	[0.051]	[0.235]	[0.082]
Observations	8,704	8,704	8,704	8,704	8,704	8,704

Robust standard errors clustered on practice in brackets.
Poisson regression coefficients using weekend (and full week) A&E counts from each practice (1/4/2009-28/2/2014).
practice and week fixed effects.

Table 7: **Impact on A&E case counts by house price in patients' neighbourhood**

	All cases	Admissions	Minor	Moderate	Ambulance	Accident
			Weekend			
7-DO	-0.107***	-0.035	-0.042	-0.101**	-0.185***	-0.116
	[0.035]	[0.121]	[0.093]	[0.041]	[0.063]	[0.292]
Price>Median	0.997***	0.183	0.665**	1.190***	1.105***	-0.620
	[0.144]	[0.261]	[0.298]	[0.237]	[0.232]	[0.393]
7-DO*(P>Median)	-0.153**	-0.164	-0.131	-0.199***	-0.069	-0.178
	[0.068]	[0.182]	[0.110]	[0.074]	[0.129]	[0.305]
Constant	0.099	-0.965***	-0.961***	-1.238***	-1.646***	-1.079***
	[0.089]	[0.186]	[0.209]	[0.132]	[0.244]	[0.251]
Observations	17,408	17,408	17,408	17,408	17,408	17,408
			Weekly			
7-DO	-0.032	-0.006	-0.049	-0.016	-0.030	-0.118
	[0.039]	[0.062]	[0.059]	[0.053]	[0.077]	[0.317]
Price>Median	1.107***	0.955***	1.114***	0.965***	1.725***	-0.673***
	[0.096]	[0.212]	[0.171]	[0.134]	[0.251]	[0.200]
7-DO*(P>Median)	-0.139**	-0.079	0.037	-0.263***	-0.175**	-0.063
	[0.067]	[0.107]	[0.075]	[0.069]	[0.071]	[0.209]
Constant	1.282***	-0.219	0.147	0.127	-0.905***	0.123
	[0.056]	[0.145]	[0.145]	[0.078]	[0.248]	[0.085]
Observations	17,408	17,408	17,408	17,408	17,408	17,408

Robust standard errors clustered on practice in brackets.
Poisson regression coefficients using weekend (and full week) A&E counts from each practice (1/4/2009-28/2/2014).
Price>Median is a dummy for the average house price in the patient's neighbourhood being greater than the median house price (£531,700) in the full sample. See text for details.
practice and week fixed effects.

Table 8: **Donald and Lang 2-Stage Fixed Effects Estimates (Weekend)**

	All cases	Admissions	Minor	Moderate	Ambulance	Accident
			Connaught Square Practice			
OLS FE	-2.305***	-0.062	-0.226**	-1.360***	-0.560***	-0.677***
	[0.241]	[0.054]	[0.101]	[0.121]	[0.054]	[0.103]
DL-NW	-2.305***	-0.062	-0.226	-1.360***	-0.560***	-0.677***
	[0.465]	[0.155]	[0.180]	[0.323]	[0.200]	[0.180]
			North West London Medical Centre			
OLS FE	-1.181***	-0.072	0.008	-0.300**	-0.237***	0.097
	[0.245]	[0.056]	[0.109]	[0.120]	[0.055]	[0.098]
DL-NW	-1.181***	-0.072	0.008	-0.300	-0.237	0.097
	[0.371]	[0.171]	[0.189]	[0.228]	[0.145]	[0.102]
			Westminster and Pimlico Health Centre			
OLS FE	-1.210***	-0.230***	-0.695***	-0.701***	-0.216***	0.259**
	[0.249]	[0.054]	[0.108]	[0.124]	[0.058]	[0.097]
DL-NW	-1.210*	-0.230	-0.695	-0.701**	-0.216	0.259
	[0.710]	[0.223]	[0.543]	[0.340]	[0.269]	[0.198]
			Third Floor Lanark Road Medical Centre			
OLS FE	-1.386***	-0.180***	-0.032	-0.586***	-0.236***	-0.102
	[0.254]	[0.053]	[0.124]	[0.143]	[0.068]	[0.095]
DL-NW	-1.386***	-0.180	-0.032	-0.586*	-0.236	-0.102
	[0.427]	[0.181]	[0.205]	[0.318]	[0.233]	[0.074]
N (OLS FE)	7936	7936	7936	7936	7936	7936
N (DL-NW)	256	256	256	256	256	256

OLS regression coefficients on the 7-day opening dummy using weekend counts of A&E cases for the period 1/4/2009-28/2/2014.
The OLS FE coefficient is computed in an OLS regression using practice and week fixed effects for each pilot practice in turn (dropping the other pilots.)
The DL-NW coefficient is computed using the Donald and Lang 2-stage method with Newey West standard errors (5 lags).